Spectrometer Case Study (Uno Co., Ltd.)

Uno Co., Ltd.

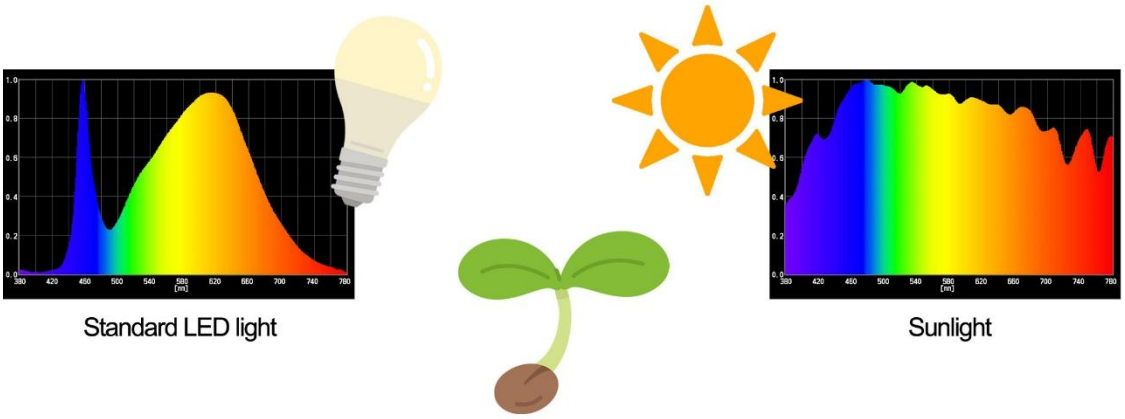
C-7000 is a tool for understanding the conditions of light source for indoor plant growth

■ Uno Co., Ltd. - In-house hydroponic cultivation to seek the conditions for expanding sales

Uno Co., Ltd., a general trading company for precision measuring instruments, conducts hydroponic cultivation in-house and records the growth status of vegetables and measurement results, using various types of measuring instruments, to stimulate demand for measuring instruments for the agricultural market. The aim is to understand the necessary conditions and measurement methods for growing plants, which will provide suggestions for selling measuring equipment to the agricultural market. Let's take a look at how they utilize C-7000 in the hydroponic cultivation process.

■ Why is C-7000 practical for indoor plant growth?

Plants require light for photosynthesis. Sunlight is ideal, but when growing the plants indoors, for instance hydroponic culture and vegetables, artificial light such as LED light sources is often used instead of sunlight. There are various types of LED light sources on the market, for example, ones with integrated three primary colors, or ones combining a blue or near-ultraviolet LED with light from a fluorescent substance. The wavelength characteristic greatly varies depending on the types of LED.



The intensity of light that affects photosynthesis is often expressed as illuminance (lx), but more accurately it needs to be expressed as photosynthetically active radiation, and the photosynthetic photon flux density (PPFD) is used as a physical quantity. Photosynthetic photons are light particles of wavelengths that are absorbed by chlorophyll during photosynthesis. PPFD indicates how many light photons in the wavelength range of 400nm to 700nm are incident per square meter per second (unit: μmol・m^{-2}・s^{-1}).

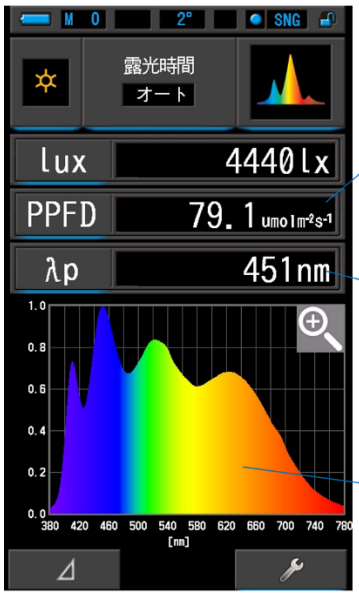
In general, it is said that leafy vegetables such as lettuce, parsley, and kale require 100 μmol・m^{-2}・s^{-1} to grow to a level that can be shipped, while tomatoes and eggplants, which bear fruit, require 200 μmol・m^{-2}・s^{-1} or more.

Typical illuminometers measure only illuminance (lx), but C-7000 can also measure PPFD and that allows one to measure the amount of light necessary for plant growth.

There are two types of plants: those that need light to germinate seeds and those that do not need light. The type of seed that does require light to germinate is called a photophilic seed (light germinating seed), while the type that does not require light and germinates better in the dark, is called a photophobic seed (dark germinating seed). Plants have a light-sensitive protein called phytochrome, and it is the difference in the phytochrome reaction which determines whether a seed is photophilic or photophobic.

To germinate photophobic seeds, they must be sown in a moist sponge and then covered to

prevent light exposure, while photophilic seeds must be exposed to red light, which activates phytochrome. Sunlight contains red light so there is no problem when growing plants outdoors, but when growing indoors, you can check the spectral graph on C-7000 to see if the lighting used contains red light.



PPFD (Photosynthetic Photon Flux Density)
The amount of light (luminous flux) a plant receives per unit time and per unit area in the wavelength range necessary for photosynthesis (400nm to 700nm) (Unit: $\mu mol \cdot m^{-2} \cdot s^{-1}$)

λp (Peak Wavelength)
The wavelength with the highest output in the spectral distribution of the light source

Spectral Graph
You can see the spectral distribution of the light source at a glance, making it easy to check whether the light source you are using is suitable for the plants you are growing

Various factors affect germination, including temperature, humidity, ventilation, and individual characteristics of a seed. The type of light used is also one of these factors. Since it is difficult to check the spectral composition of light with the human eye, it is necessary to determine if the light is appropriate for the seed by using a dedicated measuring device. If it is difficult to expose seeds to sunlight indoors, C-7000 can be a practical tool to check the PPFD and spectrum to see if the lighting used for growing is suitable for germination.

■Product information of Sekonic's spectrometer C-7000
If you are interested in Sekonic's spectrometer C-7000, please visit the product page below. Please feel free to contact us using the inquiry form below for inquiries about our products.

・Spectrometer C-7000
https://www.sekonic.co.jp/english/product/spectrometer/c_7000/c_7000.html

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